

REMARKS

Reconsideration and allowance of the above-referenced application are respectfully requested.

Upon entry of this amendment, claims 26-30, 32-55, 57-76, 78-79, 81-91, 93-99, and newly added claims 103-106 will remain in the application.

Claims 34, 39, 59, 64, 76, 78, 79, 83, 87, 89-93, 95, 99, and 102 were rejected under 35 U.S.C. 102(e) as being allegedly anticipated by or, in the alternative, under 35 U.S.C. 103(a) as being allegedly obvious over Funada et al. (US 5,614,426).

Claim 94 was rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over Funada et al.

Claims 26-30, 32-55, 57-76, 78, 79, and 81-102 were rejected under the judicially created doctrine of obviousness-type double patenting as being allegedly unpatentable over claims 1-30 of Tanaka et al. (US 6,251,712).

Claims 26-30, 32-55, 57-76, 78, 79, and 81-102 were also provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being allegedly unpatentable over claims 39-43, 45-50, 85, 87, 88, and 90-146 of copending Application Ser. No. 08/928,750.

Applicants teach forming a layer including a gettering material over a semiconductor layer film after crystallization, or alternatively, implanting a gettering material into a top portion of the crystallized semiconductor film and then removing the top layer or top portion including the gettering material (see Figures 1B and 2B).

Each of Funada et al., Tanaka et al., and copending application 08/928,750 disclose implanting an impurity into a

crystallized semiconductor layer to form an active region in a device and then heating the semiconductor layer to getter a metal catalyst into the active region. For example, phosphorous, which may also be used as a gettering material, may be implanted into the semiconductor layer to form an n-type region. The active region is an integral part of the device, and is not removed after the gettering process.

Consider exemplary independent claims 26 and 81, as amended, which recite in relevant part:

"... forming a gettering layer over said semiconductor film after the crystallization; and

heating said semiconductor film and said gettering layer at a temperature from 500EC to 800EC in order to getter the catalyst metal in said semiconductor film using said gettering layer."

"... introducing a gettering element into a portion of said crystallized semiconductor film;

heating said semiconductor film after introducing said gettering element at a temperature from 500EC to 800EC in order to getter the metal in said semiconductor film; and

removing said portion after gettering the metal in said semiconductor film."

None of Funada et al., Tanaka et al., and copending Application Ser. No. 08/928,750 teach or suggest, either alone or in combination, forming a layer including a gettering material over a crystallized semiconductor film or implanting a gettering material into a top portion of a crystallized semiconductor film and then removing that top portion after a

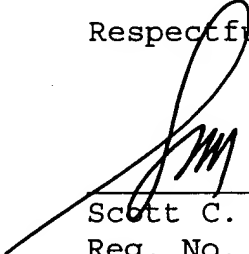
getting operation. Accordingly, Applicant submits that all pending claims are allowable.

Attached is a marked-up version of the changes being made by the current amendment.

Applicant asks that all claims be allowed. No fees are due at this time. Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

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Version with markings to show changes made

In the claims:

Claim 92, and 100-102 have been cancelled.

Claim 26, 34, 42, 51, 59, 67, 76, and 81-89 have been amended as follows:

26. (Amended) A method of manufacturing a device comprising the steps of:

providing a semiconductor film on an insulating surface;

providing [the] said semiconductor film with a catalyst metal-containing material;

crystallizing said semiconductor film by heating in a way that causes said catalyst metal to diffuse through the semiconductor film and function to promote the crystallization of the semiconductor film;

forming a gettering layer [in contact with] over said semiconductor film after the crystallization[, said gettering layer including phosphorus]; and

heating said semiconductor film and said gettering layer at a temperature from 500°C to 800°C in order to getter the catalyst metal in said semiconductor film using said gettering layer.

34. (Amended) A method of manufacturing a device comprising the steps of:

providing a substantially intrinsic semiconductor film on an insulating surface;

providing said semiconductor film with a catalyst metal-containing material;

crystallizing said semiconductor film by heating in a way that causes said catalyst metal to diffuse through the semiconductor film and function to promote the crystallization of said semiconductor film;

forming a gettering layer [in contact with] over said semiconductor film after the crystallization[, said gettering layer including phosphorus]; and

heating said semiconductor film and said gettering layer in order to getter the catalyst metal in said semiconductor film by said gettering layer.

42. (Amended) A method of manufacturing a device comprising the steps of:

providing a semiconductor film on an insulating surface;

providing a catalyst metal-containing material on said semiconductor film;

crystallizing said semiconductor film by heating in a way that causes said catalyst metal to diffuse through the semiconductor film and function to promote the crystallization of said semiconductor film;

forming a gettering layer [in contact with] over said semiconductor film after the crystallization[, said gettering layer including phosphorus]; and

heating said semiconductor film and said gettering layer in a nitrogen atmosphere in order to getter the catalyst metal contained in said semiconductor film by said gettering layer.

51. (Amended) A method of manufacturing a device having a junction, said method comprising the steps of:

providing a semiconductor film comprising amorphous silicon on an insulating surface;

providing a catalyst metal-containing material on said semiconductor film;

crystallizing said semiconductor film by heating in a way that causes said metal to diffuse through the semiconductor film and to promote the crystallization thereof;

forming a gettering layer [in contact with] over said semiconductor film after the crystallization[, said gettering layer including phosphorus];

heating said semiconductor film and said gettering layer at a temperature from 500°C to 800°C in order to getter the metal included in said semiconductor film by said gettering layer; and

forming a doped semiconductor film on said semiconductor film to form a junction.

59. (Amended) A method of manufacturing a device having a junction, said method comprising the steps of:

providing a substantially intrinsic semiconductor film on an insulating surface;

providing a catalyst metal on said semiconductor film;

crystallizing said semiconductor film by heating to cause said catalyst metal to diffuse through the semiconductor film and to promote the crystallization of said semiconductor film;

forming a gettering layer [in contact with] over said semiconductor film after the crystallization thereof[, said gettering layer including phosphorus];

heating said semiconductor film and said gettering layer in order to getter the catalyst metal in said semiconductor film by said gettering layer; and forming a junction using said intrinsic semiconductor film.

67. (Amended) A method of manufacturing a device having a junction, said method comprising the steps of:

providing a semiconductor film comprising amorphous silicon formed on an insulating surface;

providing a catalyst metal-containing material on said semiconductor film;

crystallizing said semiconductor film by heating in a way that causes said catalyst metal to diffuse through the semiconductor film and function to promote the crystallization of said semiconductor film;

forming a gettering layer [in contact with] over said semiconductor film after the crystallization[, said gettering layer including phosphorus]; and

heating said semiconductor film and said gettering layer in a nitrogen atmosphere in order to getter the catalyst metal contained in said semiconductor film by said gettering layer; and

forming a junction on said semiconductor film.

76. (Amended) A method of manufacturing a device, comprising the steps of:

providing a semiconductor film on an insulating surface;

forming a catalyst metal-containing material on said semiconductor film, said catalyst being a material which

facilitates crystallization of said semiconductor film [to be formed more easily], but which when present in a final product of the device [will degrade] degrades operation of the device;

crystallizing said semiconductor film by heating in a way that causes said catalyst metal-containing material to diffuse into at least a part of the semiconductor film, said catalyst metal-containing material when so diffused functioning to facilitate said crystallization;

forming a gettering layer [in contact with] over said semiconductor film after said crystallization[, said gettering layer including phosphorus]; and

processing said semiconductor film and said gettering layer to remove at least one portion of said catalyst metal in said semiconductor film.

81. (Amended) A method of manufacturing a device comprising the steps of:

providing a semiconductor film on an insulating surface;

providing said semiconductor film with a metal-containing material;

crystallizing said semiconductor film by heating in a way that causes said metal to diffuse through the semiconductor film and function to promote the crystallization of the semiconductor film;

introducing [phosphorus] a gettering element into a portion of said crystallized semiconductor film [by plasma doping];

heating said semiconductor film after introducing said [phosphorus] gettering element at a temperature from 500°C to

800°C in order to getter the metal in said semiconductor film;
and

removing said portion after gettering the metal in
said semiconductor film.

82. (Amended) A method of manufacturing a device
comprising the steps of:

providing a semiconductor film doped with boron at a
concentration of 0.001-0.1 atm% on an insulating surface;

providing said semiconductor film with a metal-
containing material;

crystallizing said semiconductor film by heating in a
way that causes said metal to diffuse through the semiconductor
film and function to promote the crystallization of said
semiconductor film;

forming a gettering layer [in contact with] over said
semiconductor film after the crystallization[, said gettering
layer including phosphorus]; and

heating said semiconductor film and said gettering
layer in order to getter the metal in said semiconductor film by
said gettering layer.

83. (Amended) A method of manufacturing a device
comprising the steps of:

providing a substantially intrinsic semiconductor film
on an insulating surface;

providing said semiconductor film with a metal-
containing material;

crystallizing said semiconductor film by heating in a
way that causes said metal to diffuse through the semiconductor

film and function to promote the crystallization of said semiconductor film;

introducing [phosphorus] a gettering element into a portion of the crystallized semiconductor film [by plasma doping];

heating said semiconductor film after introducing [phosphorus] said gettering element in order to getter the metal in said semiconductor film; and

removing said portion after gettering the metal in said semiconductor film.

84. (Amended) A method of manufacturing a device comprising the steps of:

providing a semiconductor film doped with boron at a concentration of 0.001-0.1 atm% on an insulating surface;

providing said semiconductor film with a metal-containing material;

crystallizing said semiconductor film by heating in a way that causes said metal to diffuse through the semiconductor film and function to promote the crystallization of said semiconductor film;

introducing [phosphorus] a gettering element into a portion of the crystallized semiconductor film [by plasma doping];

heating said semiconductor film after introducing [phosphorus] said gettering element in order to getter the metal in said semiconductor film; and

removing said portion after gettering the metal in said semiconductor film.

85. (Amended) A method of manufacturing a device comprising the steps of:

providing a semiconductor film on an insulating surface;

providing a metal-containing material on said semiconductor film;

crystallizing said semiconductor film by heating in a way that causes said metal to diffuse through the semiconductor film and function to promote the crystallization of said semiconductor film;

introducing [phosphorus] a gettering element into a portion of the crystallized semiconductor film [by plasma doping];

heating said semiconductor film in a nitrogen atmosphere after introducing [phosphorus] said gettering element in order to getter the metal contained in said semiconductor film; and

removing said portion after gettering the metal in said semiconductor film.

86. (Amended) A method of manufacturing a device having a junction, said method comprising the steps of:

providing a semiconductor film doped with boron at a concentration of 0.001-0.1 atm% on an insulating surface;

providing a metal on said semiconductor film;

crystallizing said semiconductor film by heating to cause said metal to diffuse through the semiconductor film and to promote the crystallization of said semiconductor film;

forming a gettering layer [in contact with] over said semiconductor film after the crystallization thereof[, said gettering layer including phosphorus];

heating said semiconductor film and said gettering layer in order to getter the metal in said semiconductor film by said gettering layer; and

forming a junction using an intrinsic semiconductor film.

87. (Amended) A method of manufacturing a device having a junction, said method comprising the steps of:

providing a substantially intrinsic semiconductor film on an insulating surface;

providing a metal on said semiconductor film;

crystallizing said semiconductor film by heating to cause said metal to diffuse through the semiconductor film and to promote the crystallization of said semiconductor film;

introducing [phosphorus] a gettering element into a portion of the crystallized semiconductor film [by plasma doping];

heating said semiconductor film after introducing [phosphorus] said gettering element in order to getter the metal in said semiconductor film by said phosphorus; [and]

removing said portion after gettering the metal in said semiconductor film; and

forming a junction using a doped semiconductor film.

88. (Amended) A method of manufacturing a device having a junction, said method comprising the steps of:

providing a semiconductor film doped with boron at a concentration of 0.001-0.1 atm% on an insulating surface;

providing a metal on said semiconductor film;

crystallizing said semiconductor film by heating to cause said metal to diffuse through the semiconductor film and to promote the crystallization of said semiconductor film;

introducing [phosphorus] a gettering element into a portion of the crystallized semiconductor film [by plasma doping];

heating said semiconductor film and said gettering [layer] element in order to getter the metal in said semiconductor film [by said phosphorus]; [and]

removing said portion after gettering the metal in said semiconductor film; and

forming a junction using an intrinsic semiconductor film.

89. (Amended) A method of manufacturing a device comprising the steps of:

providing a semiconductor film on an insulating surface;

forming a metal-containing material on said semiconductor film, said metal being a material which facilitates crystallization of said semiconductor film [to be formed more easily], but which when present in a final product of the device [will degrade] degrades operation of the device;

crystallizing said semiconductor film by heating in a way that causes said metal-containing material to diffuse into at least a part of the semiconductor film, said metal-containing material when so diffused functioning to facilitate said crystallization;

introducing [phosphorus] a gettering element into a portion of the crystallized semiconductor film [by plasma doping];

processing said semiconductor film after introducing [phosphorus] said gettering element to remove at least one portion of said metal in said semiconductor film; and removing said portion after gettering the metal in said semiconductor film.

Claims 103, 104, 105, and 106 are added.

--103.(New) A method according to any one of claims 26, 34, 42, 51, 59, 67, 76, 82, or 86 wherein said gettering layer is formed by a CVD method.

104.(New) A method according to any one of claims 81, 83-85, or 87-89, wherein said gettering element comprises phosphorus.

105.(New) A method according to any one of ~~claims 81,~~ 83-85, or 87-89, wherein said gettering element is introduced by a plasma doping method.

106.(New) A method according to any one of claims 26, 34, 42, 51, 59, 67, 76, 82, or 86, wherein said gettering layer is in contact with said semiconductor film.--